



ITOS to EDGE “Bridge” Software for Morpheus Lunar/Martian Vehicle

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Abstract

My project involved improving upon existing software and writing new software for the Project Morpheus Team. Specifically, I created and updated Integrated Test and Operations Systems (ITOS) user interfaces for on-board interaction with the vehicle during archive playback as well as live streaming data. These interfaces are an integral part of the testing and operations for the Morpheus vehicle providing any and all information from the vehicle to evaluate instruments and insure coherence and control of the vehicle during Morpheus missions. I also created a “bridge” program for interfacing “live” telemetry data with the Engineering DOUG Graphics Engine (EDGE) software for a graphical (stand-alone or VR dome) view of live Morpheus flights or archive replays, providing graphical representation of vehicle flight and movement during subsequent tests and in real missions.



Introduction

I was selected to work at NASA-Johnson Space Center this summer under my mentor, Robert Hirsh, working in the Engineering Robotics Division (ER6) to create and update software for the MORPHEUS Team throughout the course of my internship. Project Morpheus is a vertical test bed demonstrating new green propellant propulsion systems and autonomous landing and hazard detection technology. Designed, developed, manufactured and operated in-house by engineers at NASA's Johnson Space Center, the Morpheus Project represents not only a vehicle to advance technologies, but also an opportunity to try out “lean development” engineering practices.

Methods

The early stages of the project consisted of familiarizing myself with Linux shell scripting and C++. The first stage of the project entailed using NASA's GUI page-builder to isolate problem mnemonics causing the CPU to overload and assisted in source code debugging. I was then tasked with updating existing ITOS pages by altering each element to make room to add thruster temperatures and fail indicators. I wrote the code to create a graphical representation of each of the new mnemonics I had added. The subsequent project I worked on detailed researching and writing new code to produce real time and archive replay visualization for tracking and analysis of the Morpheus vehicle. I choose to write a C++ code that opened a client to “bridge” the live telemetry data from the vehicle and push it into the already existing EDGE visualization software.



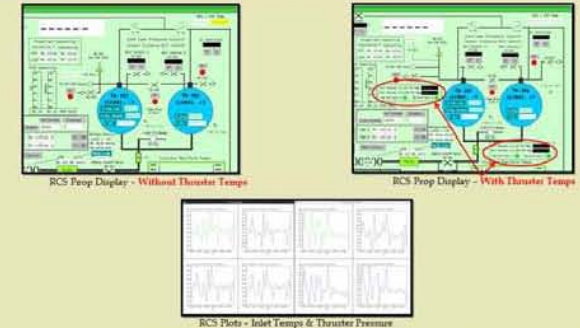
Results & Discussion

I was able to complete each task assigned this summer and took on additional projects to help other divisions with various tasks such as the ITOS interface pages. For my first task, I was able to track down and isolate the problem mnemonics on each of the pages, remove them, and recreate them in another window until I was able to sit down with my mentor and determine that the problem was a NaN value that was conflicting with the expected value which resulted in overloading the CPU.

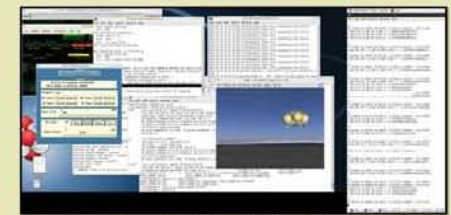


ITOS pages with problem mnemonics removed and work around implemented

I was then tasked with updating ITOS pages with thruster temperatures and fail indicators requiring me to code graphical charts for each of the newly added mnemonics.



During the second part of summer, I worked to create a “bridge” program to produce real time and archive replay visualization for tracking and analysis of the Morpheus vehicle. I was able to achieve the desired outcome and my program accurately created a visualization of the vehicle's telemetry data as it was being replayed. This software was used to visualize live streaming CCSDS data for subsequent flight tests.



Program running alongside archive replay showing it affecting the visualization model

Conclusion

Throughout my internship I delivered quality work on each project to which I was assigned or volunteered for, I demonstrated a high level of competence, taking the initiative to work on my own or in seeking out different projects or assistance. I was fortunate enough to be chosen to work on one of NASA's most recognizable rapid development projects, Project Morpheus, giving me a complete and enjoyable internship experience I will never forget.